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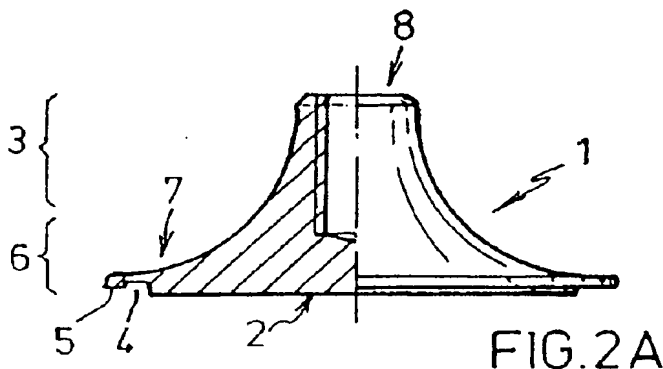
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(54) **Glass panel attachment**

(57) A connecting apparatus (1) is attached to a glass panel by gluing it together with the glass panel. For this purpose, an apparatus (1) is provided for constructionally connecting a glass panel to a supporting structure, which apparatus comprises a surface (2) for gluing together with the glass panel, and a connecting means (3) for attaching the apparatus (1) to the supporting

structure, the glue surface (2) being rotationally symmetrical with a circular contour and the glue surface (2) being provided with a groove (4) running along its periphery. Furthermore, a glass panel is provided, comprising at least one such connecting apparatus (1) which is glued together with this.



Description

The present invention relates to the constructional attachment of glass panels, including apart from single glass plates also multi-composed glass panels such as double glass panels, having a conditioned cavity.

Building fronts, windows, doors and frames in the building industry traditionally consist of a wooden, metal or plastic window-frame with a, transparent or otherwise, pane of a glass or plastic placed therein. In architectural circles, however, the need has arisen for glazing without frames, wherein the glass surfaces are formed by separate glass plates which have been built up without the aid of frames. In order to form walls and roofs large glass surfaces are often used, larger than the dimension of one glass plate, in which the glass plates should be mutually coupled. Usually this is done by a bolt connection near a corner of the glass plate, in which the bolt connects the corner of the glass plate to a metal coupling piece, via which coupling piece two, four or even more glass plates are then coupled. In order to be spatially stable, these coupling pieces require an external supporting structure, such as a column, a front post, a beam, a lattice girder or a structure of cables or tension wires and strut trusses. The glass surface then consists of several flat glass plates, provided at their corners or near their long sides with holes through which the bolts are passed.

A drawback to this bolt connecting method is that holes must be drilled in the glass panel, which can for instance cause cracking or breaking. Moreover, the bolt, if it is made of steel, may not directly come into mechanical contact with the glass, since this will cause the glass to crack or break under the occurring high local peak stresses, and the bolt connection should be sealed at the location of the glass plate in order to keep the relevant glass surface of the building wind- and watertight. To this end, additional provisions are necessary, such as for instance a sealing ring of a tough material such as a deformable metal or a synthetic material or rubber.

When double glass panels are used, perforating the panels causes even more drawbacks. Such panels are supplied prefabricated with a conditioned cavity which is screened gastight and watertight from the outside world by means of a reliable sealing provided along the perimeter of the glass plates. A significant drawback to the present-day attaching method of drilling through such a double glass panel is that measures should also be taken to again achieve this high-grade seal. For this purpose, sealing rings should be provided in the bore holes and in the cavity. However, this does not remove the risk of leakage of gas and water into the cavity.

A connecting apparatus according to the preamble of claim 1 is known from German patent specification DE-A-38 06 254.

This allows the glass panel, without a hole needing to be present or to be made in this, to be mounted to a supporting structure, so that fitting additional seals at the location of the attachments is no longer necessary and, in the case of a double glass panel, the conditioned cav-

ity is not penetrated, and the risk of leakage is not increased.

A drawback to the known apparatus, however, is that the gluings onto glass obtained thereby do not have a reproducible shape. This results in ugly, irregular glue connections which will be visible through the glass panel. Furthermore, during gluing, superfluous glue will be uncontrollably pressed out from between the apparatus and the glass panel, which spilled glue must be removed thereafter.

It is the object of the invention to obviate the drawbacks to the state of the art, in that the glue surface is provided with a groove running along its periphery. During application of the connecting apparatus on the glass, superfluous glue can flow into this. When the connecting apparatus is rotatably applied on the glass panel, the groove can be made to fill up with glue up to its outer groove wall, as a consequence of which a circular gluing with a reproducible diameter is obtained.

The glue surface of the known connecting apparatus is rotationally symmetrical with a circular contour. A flat glue surface will be sufficient for most applications (flat glass panels). Such a connecting apparatus can advantageously be attached on a glass panel by applying an exact amount of glue on to the glue surface thereof and/or on to the attachment surface of the glass panel, and by subsequently rotatably applying the connecting apparatus with its base to the attachment surface of the glass panel. The distribution of the glue during gluing can advantageously be observed by means of a mirror placed behind the glass panel. In this way, a reproducible, almost circular glue front can be obtained, which, for instance when the glue surfaces are visible in a glass front, is highly desirable in order to obtain an architecturally uniform and severe aspect.

Preferably, the contour edge of the groove situated on the outside of the groove is retracted, so that during gluing it remains at a greater distance from the glass panel than the glue surface. This prevents the connecting apparatus from coming into direct contact with the glass panel, which, if the connecting apparatus is made of a tougher and less resilient material than glass, such as for instance stainless steel, can lead to the glass cracking or breaking.

It is furthermore preferred that the connecting apparatus comprises a base flaring outwards from the connecting means to the glue surface, for instance in the shape of a cone. This causes the surface tensions from the glass to be absorbed across a large glue surface, so that the glue connection is not overloaded, and these tensions are concentrated in the connecting means.

It is herein advantageous if the base flares out being thin towards the edge of the glue surface in the shape of a trumpet. The thinned down trumpet base edge has a deforming function which allows for a well maintained glue connection on the edge of the glue surface. When the glue connection is loaded with a bending moment, the trumpet edge is deformed relative to the connecting means: Because the glue connection is rigid, the trumpet

edge remains in place relative to the glass panel. This prevents the glue from being peeled off at the location of the edge of the glue surface. The thickness of the base near the glue surface edge is preferably less than 1 mm.

Furthermore, it is preferred that the connecting means comprises a bore hole with an internal screw thread. A bolt or threaded end can be applied in this for connection of the glued glass panel to a metal coupling piece, as is usual. A detachable connection of a different type can of course also be used.

The connecting apparatus can be made from one piece of a metal or a metal alloy or a synthetic material, and is preferably made of stainless steel or aluminium. In view of its great resilient deformability, aluminium is preferred in applications in which bending moment loading of the glue connection occurs, in order to prevent peeling of the glue connection.

A suitable glue for this application is an epoxy-based glue. Such a glue produces a very rigid glue connection which cannot easily be peeled off. A different type of glue, which is compatible with glass and the material of the connecting means, and which forms a rigid glue connection, can of course be used as well. In order to obtain a strong and rigid glue connection, the thickness of the glue layer is preferably less than 1 mm. It has been found that such a glue connection is suitable for the attachment of glass panels in horizontal, gabled and sloping roofs, as well as in vertical walls, and can be loaded with the tensile, pressure and shearing forces occurring therein and offers sufficient resistance to creep in lengthy loads.

In a glass front in which the supporting structure is located on the inside of the building, the glue layer will be exposed to, direct or indirect, sunlight. For that reason, preferably a glue is used which is resistant to ultraviolet light.

The glue surface of the connecting apparatus is preferably textured or roughened, for instance by a lathe operation, and the attachment surface of the glass panel is preferably roughened prior to the gluing, for instance by sand blasting or etching. This increases the application surfaces or the binding surfaces for the glue, and results in a glue connection which is more resistant to shearing forces.

The invention will be further explained on the basis of several exemplary embodiments, with reference to the drawings, in which:

figure 1 shows a perspective view of an embodiment of a connecting apparatus according to the invention,

figure 2A shows a partially cut-open side view of the connecting apparatus of figure 1,

figure 2B shows a bottom view of the connecting apparatus of figure 2A,

figure 3A shows a partially cut-open side view of another embodiment of a connecting apparatus according to the invention,

figure 3B shows a bottom view of the connecting apparatus of figure 3A,

figure 4A shows a partially cut-open side view of a third embodiment of a connecting apparatus according to the invention, and

figure 4B shows a bottom view of the connecting apparatus of figure 4A.

In the figures, similar parts have been indicated by similar reference numerals. The perspective view of figure 1 presents a general impression of a connecting apparatus 1 according to the invention, comprising as main components a base 6 and a connecting means 3. The base 6 has at its bottom side a glue surface 2 and the connecting means 3 comprises a bore hole 8 with an internal screw thread which can be connected, by means of a bolt or threaded end, to a coupling piece in order to hang on to it a glass panel glued together with the glue surface 2.

The force to be transmitted by the connecting apparatus 1 is distributed over a large glue surface 2, so that the glue connection is not overloaded, and is concentrated in the connecting means 3. The connecting means 3 merges towards the glue surface 2 into the base 6, which has the flaring shape of a trumpet. The severe trumpet shape is highly suitable for use in modern architecture.

When the connecting apparatus 1 is glued together with a glass panel, a glue connection is created which is well resistant to tensile, pushing and shearing loads. A glue connection, however, is in general not really resistant to peeling loads. When the glue connection is loaded with a bending moment, a peeling force is concentrated on one side of the glue surface 2, on the edge thereof.

In figure 2A it is visible that the trumpet base 6 flares out being thin towards the edge of the glue surface 2. The thin trumpet base edge 7 has a deforming function. The trumpet edge has been thinned down such, that it is more resilient than the rigid glue connection in a direction perpendicular to the glue surface 2. That is why the trumpet edge 7 deforms when the glue connection is loaded with a bending moment. The trumpet edge 7 shifts relative to the connecting means 3 and remains in place relative to the glass panel. Owing to this, the forces occurring on the portion of the edge 7 concerned are distributed over a larger portion of the glue surface 2, as a consequence of which the glue connection can better resist peeling by a bending moment.

Figure 2A (and figure 2B) further show that the glue surface 2 is provided with a groove 4 running along its periphery for receiving superfluous glue. During gluing, the connecting means 1 is rotatably pressed on the blob of glue on the attachment surface of the glass panel. By

means of a mirror placed behind the glass panel, the distribution of the blob of glue can be observed. The rotation results in a reproducible, circular glue front, of which the overflow into the groove 4 can be observed in the mirror. The rotating and pressing of the connecting apparatus 1 is stopped at the moment at which the glue front reaches the outer wall of the groove 4. Thus, a circular gluing is created with a pre-determined diameter which is equal to the diameter of the circular outer wall of the groove 4. This gluing will become visible on the opposite side of the glass panel, and is surrounded by the outer contour edge 5 of the groove 4. This contour edge 5 of the groove 4 is retracted relative to the glue surface 2, to ensure that the connecting apparatus does not come into direct contact with the glass panel.

The connecting apparatus 1 is preferably made of one piece of stainless steel. It is of the utmost importance, herein, in order to prevent cracking or breaking of the glass, that the steel, which is far tougher than the glass, does not come into contact with the glued glass panel. A steel connecting apparatus 1 according to the figures 2A and 2B is suitable for applications in which the glue connection is not loaded with a great bending moment, such as for instance in glass roofs. When greater bending moments have to be absorbed, such as for instance in glass curtain walls, it is possible to use a connecting apparatus 1 according to the figures 2A and 2B, made of aluminium, which is more flexible than stainless steel. Another option is to use a steel connecting apparatus 1 according to the figures 3A and 3B, in which the trumpet base edge 7 is further thinned down to a thickness of less than 1 mm. Herein, however, on account of the required production and safety margins for the depth of the groove 4, the minimum thickness of the base and the distance across which the edge 5 of the groove 4 is retracted, it is no longer possible to provide a groove 4 around the periphery of the glue surface 2. For that reason, during the gluing together of this embodiment of the connecting apparatus 1 it is more difficult to prevent superfluous glue from coming out from under the base 6 on the edge of the glue surface 2, so that this glue surplus must be removed afterwards.

An embodiment of the connecting apparatus 1 which can be executed in stainless steel and which combines the advantages of those of figures 2A and 2B, and 3A and 3B, respectively, is shown in figures 4A and 4B. Herein, the trumpet base edge 7 is further thinned down till below the level of a bent trumpet end edge portion 9, which at its lower side forms the groove 4, and of which the end edge 5 is retracted relative to the glue surface 2.

In very critical applications in which the glue connection is loaded with extremely great bending moments, a connecting apparatus 1 according to the figures 4A and 4B, or possibly according to the figures 3A and 3B, can be used, which is made of a more flexible material than stainless steel, such as for instance aluminium or a suitable synthetic material. The manufacture of this embodiment of the connecting apparatus 1 is also easier in these materials than in stainless steel, and can for

instance take place by injection moulding a synthetic material.

Claims

1. Apparatus for constructionally connecting a glass panel to a supporting structure, provided with a surface (2) for gluing together with the glass panel, and a connecting means (3) for attaching the apparatus (1) to the supporting structure, the glue surface (2) being rotationally symmetrical with a circular contour,
characterized in that the glue surface (2) is provided with a groove (4) running along its periphery.
2. Connecting apparatus according to claim 1, characterized by a base (6) flaring outwards in the shape of a trumpet from the connecting means (3) to the glue surface (2), which base (6) flares out being thin towards the edge of the glue surface (2), the thickness of the base near the glue surface edge (7) preferably being less than 1 mm.
3. Connecting apparatus according to claim 1 or 2, characterized in that the contour edge (5) of the groove (4) situated on the outside of the groove (4) is retracted, so that during gluing it remains at a greater distance from the glass panel than the glue surface (2).
4. Connecting apparatus according to any one of the preceding claims, characterized in that the connecting means (3) comprises a bore hole (8) with an internal screw thread.
5. Connecting apparatus according to any one of the preceding claims, characterized in that it is made from one piece of stainless steel or aluminium.
6. Connecting apparatus according to any one of the preceding claims, characterized in that the glue surface (2) is textured.
7. Method for attaching a connecting apparatus according to any one of the claims 1 - 6 to a glass panel, wherein the connecting apparatus (1) is glued together with the glass panel,
characterized in that,
an exact amount of glue is applied on the glue surface (2) of the connecting apparatus (1) and/or on the attachment surface of the glass panel, and
that subsequently the connecting apparatus (1) is rotatively applied with its base (6) to the attachment surface of the glass panel.
8. Method according to claim 7, characterized in that the distribution of the glue during gluing is observed by means of a mirror placed behind the glass panel,

the attachment surface of the glass panel preferably being roughened prior to the gluing.

9. Method according to claim 7 or 8, **characterized in that** a UV-resistant glue is used, the glue preferably being dosaged such that the thickness of the glue layer after gluing is less than 1 mm. 5
10. Glass panel, provided with at least one connecting apparatus according to any one of the claims 1 - 6, which connecting apparatus is glued together with the glass panel, **characterized in that** the glue is a UV-resistant glue, the thickness of each glue layer preferably being less than 1 mm. 10

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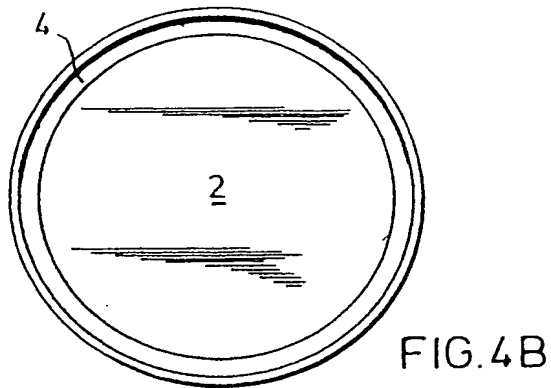
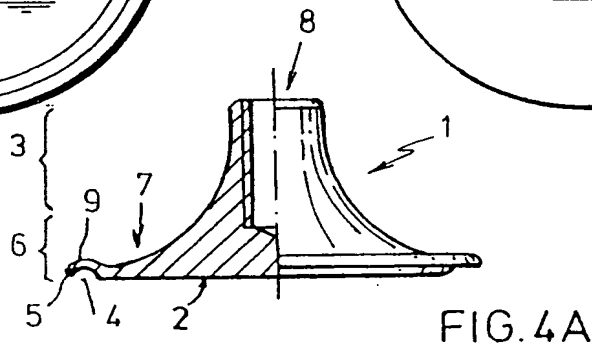
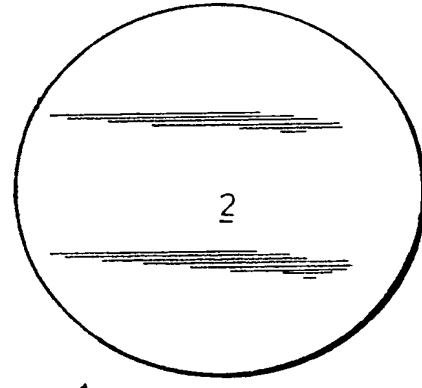
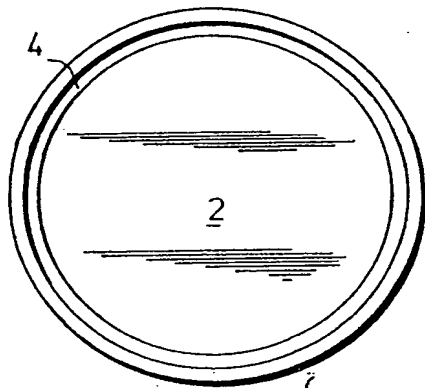
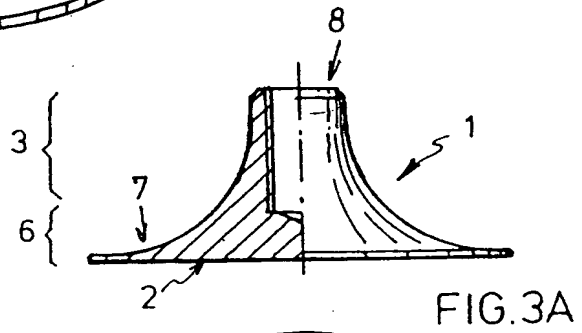
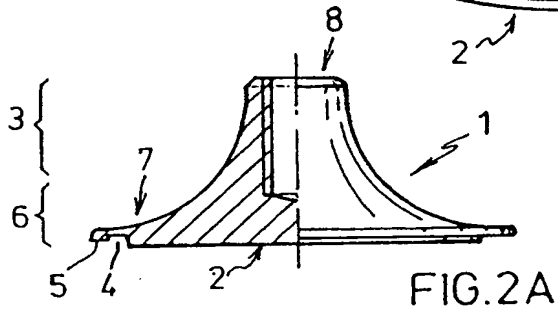
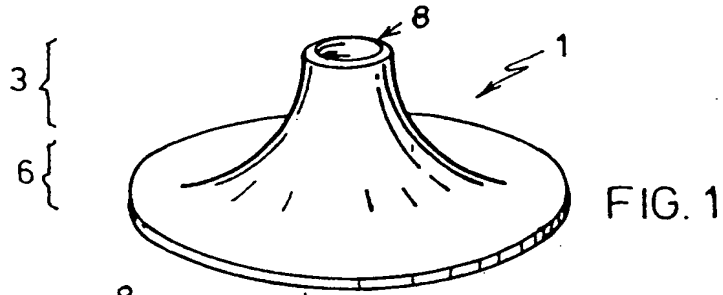
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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2741

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 January 1996	Examiner Depoorter, F
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application I : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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Application Number
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Place of search THE HAGUE		Date of completion of the search 24 January 1996	Examiner Depoorter, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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